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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/721,522	11/24/2003	Yasuhiko Sugiyama	S004-5168	5320

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EXAMINER

ROSASCO, STEPHEN D

ART UNIT	PAPER NUMBER
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1756

DATE MAILED: 06/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/721,522

Applicant(s)

SUGIYAMA ET AL.

Examiner

Stephen Rosasco

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 3/27/06.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 10-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 21-26 is/are allowed.
- 6) ☒ Claim(s) 10-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Detailed Action

In response to the Amendment of 3/27/06, wherein the pending claims 1-9 were canceled and new claims 10-26 were added, the examiner withdraws the prior office action rejections and includes a new rejection here with an additional reference. This rejection was necessitated by amendment, therefore the action is made final.

Examiner indicates that claims 21-26 are allowable.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 10-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stewart et al. (US 20040151991 A1) in view of Neary (5,882,823) and Hosono (5,272,116).

The claimed invention is directed to a mask correction method, in a correction process for removing redundant sections such as photomask opaque defects or phase shifter bump defects, comprising the steps of: coarse correction by etching using a focused ion beam;

and finishing correction by etching using an electron beam.

And comprising, before the coarse correction, a step of acquiring an SEM image using an electron beam, and a step of positioning defect correction locations on the SEM image.

And wherein the finishing processing using an electron beam is carried out while spraying etching assist gas to a beam irradiation position.

And wherein the coarse correction is carried out to leave part of the defect, and finishing processing is performed on the remaining part.

And wherein, when the defect is an opaque defect, the coarse correction removes the entire opaque defect.

Stewart et al. teach a method for repairing a opaque defect in a photolithography mask, comprising: directing an ion beam toward an area of the mask including the defect to remove material, the ion beam incidentally implanting atoms into the mask, thereby reducing its transparency; and directing an electron beam toward the area of the mask to remove a layer of the mask containing the implanted atoms and to increase the transparency of the area.

And in which directing an electron beam toward the area of the mask includes directing an etchant gas toward the area of the mask.

Stewart et al. also teach (see [0035]) Focused ion beam column 302 includes an ion source 308, preferably a gallium liquid metal ion source (LMIS). Other ion sources that could be used include a silicon/gold eutectic LMIS and a plasma ion source, depending upon the repair strategy. By using a mask simulation program as described above, skilled persons would be able to determine the effects of the implantation of materials other than gallium and use those effect to effect repair of defects. The column can use a focused beam or a shaped beam. The invention is not limited to any particular type of charged particle beam column.

The teachings of Stewart et al. differ from those of the applicant in that the applicant teaches removing only part of a defect and acquiring a SEM image of the defect area by detecting secondary ions and, (claims 15-16) when the type of detected secondary ions changes, terminating the coarse correction and automatically switching to finishing correction using an electron beam to repair damage to the mask that occurred during coarse correction.

Neary teaches a method of repairing a mask comprising the steps of: (a) providing a substrate;

(b) shining a beam on a portion of said substrate to remove a portion of said substrate and to leave a portion of said substrate comprising a thin wall; and

(c) providing a second removal step to substantially remove said thin wall, wherein said second removal step comprises a process different from said shining step (b).

wherein said shining step (b) comprises the step of shining a focused ion beam.

And further comprises isotropically etching said thin wall while said conductive coating remains in place to protect other portions of the mask during said isotropic etching step.

Hosono teaches a method of correcting a pattern defect of a photomask by removing a pattern defect of a phase shifter generated in a region where a light shielding film does not exist on the surface of a mask substrate, after the formation of a pattern of a predetermined phase shift mask including the light shielding film and the phase shifter on the mask substrate, comprising the steps of:

providing a planarization film to cover a surface of a first region, including said pattern defect on said mask substrate such that the pattern defect is encircled by the planarization film;

directing a focused ion beam on a second region on said mask substrate within said first region and including said pattern defect encircled by the planarization film for etching said planarization film in said second region and said pattern defect simultaneously; and

removing said planarization film outside said second region.

And wherein said step of etching said planarization film and said pattern defect is carried out by a focused ion beam etching using gallium ions as the irradiation ions.

And wherein said step of stopping the etching operation at the moment the etching reaches the interface of said planarization film and said mask substrate comprises the further step of monitoring in real time a secondary signal selected from a secondary electron, a secondary ion, light and an X ray generated, from the portion where etching by

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the focused ion beam is carried out, to detect a change in the intensity of the secondary signal at the moment the surface of said mask substrate is exposed and to simultaneously cease the etching process.

It would have been obvious to one having ordinary skill in the art to take the teachings of Stewart et al. and combine them with the teachings of Neary and Hosono in order to make the claimed invention because locating and removing a defect usually requires the facilitation of some kind of an imaging system in order to be able to locally treat the mask surface and the use of a secondary ion signal would have been known to be able to image the smallest features for repair.

Applicant's arguments with respect to claims 1-9 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Stephen Rosasco whose telephone number is (571) 272-1389. The Examiner can normally be reached Monday-Friday, from 8:00 AM to 4:30 PM. The Examiner's supervisor, Mark Huff, can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



S. Rosasco
Primary Examiner
Art Unit 1756

S. Rosasco
5/18/06